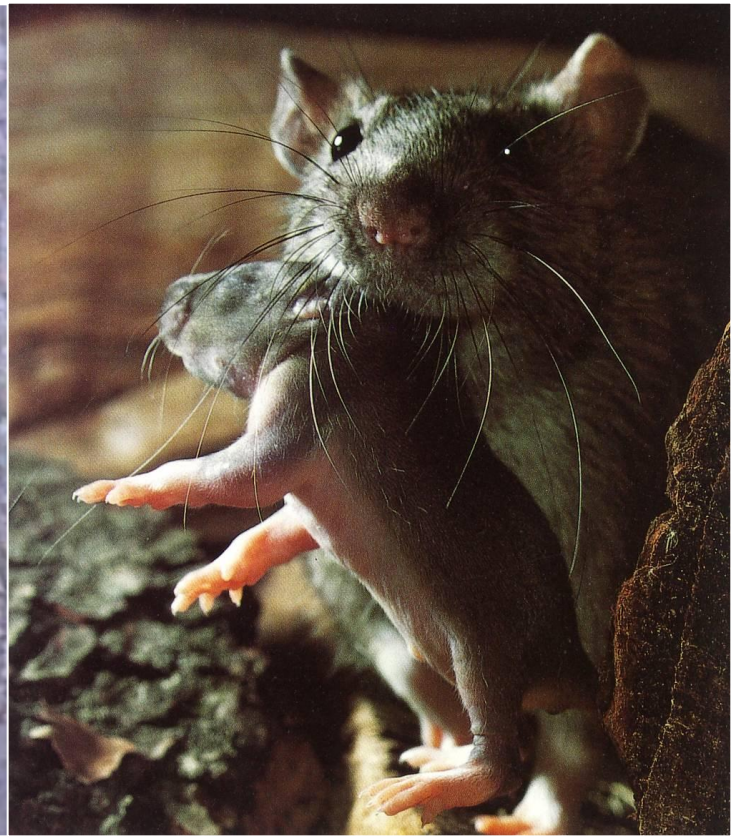
Sozialsysteme bei wilden Mäusen und Ratten



Philip Dammann, Essen

ETS NO. 123

4.5.2. Housing

Animals, except those which are naturally solitary, should be socially housed in stable groups of compatible individuals. Single housing should only occur if there is justification on veterinary or welfare grounds. […]

Sind Mäuse „natürlich solitäre" Tiere?

Falls nein: was bedeutet das für Ihre Haltung im Labor?

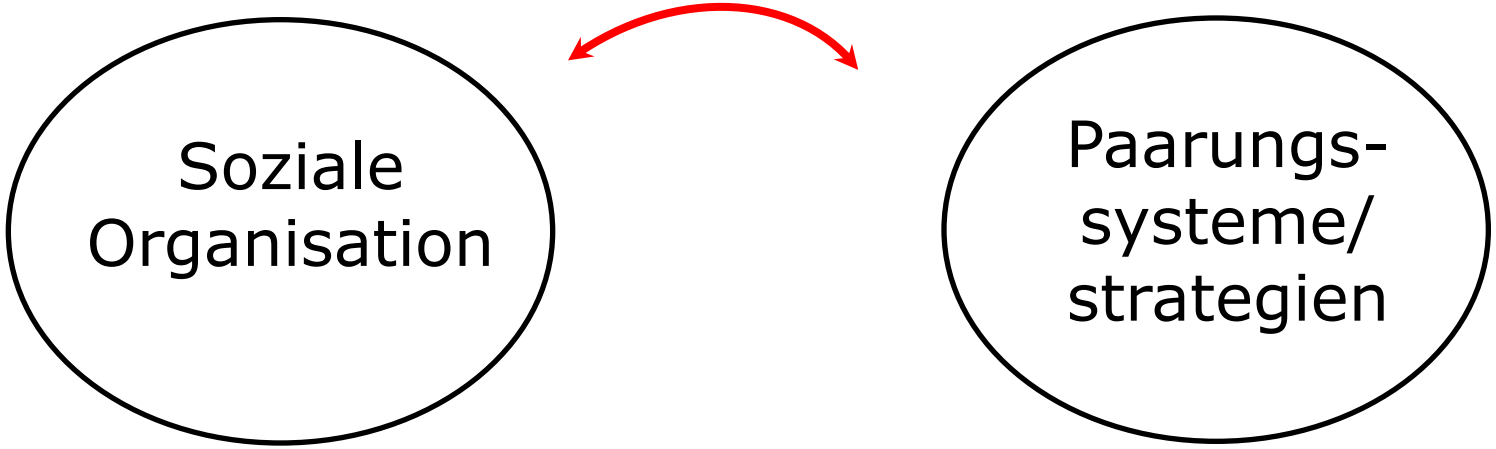
Gliederung:

- Sozialsysteme allgemein
- Sozialsysteme bei Nagetieren
- Sozialsystem wilder Mäuse und Ratten
- Konsequenzen für die Haltung

Allein oder in Gruppen?
Verwandtschaftsverhältnisse?
Räumliche Verteilung?

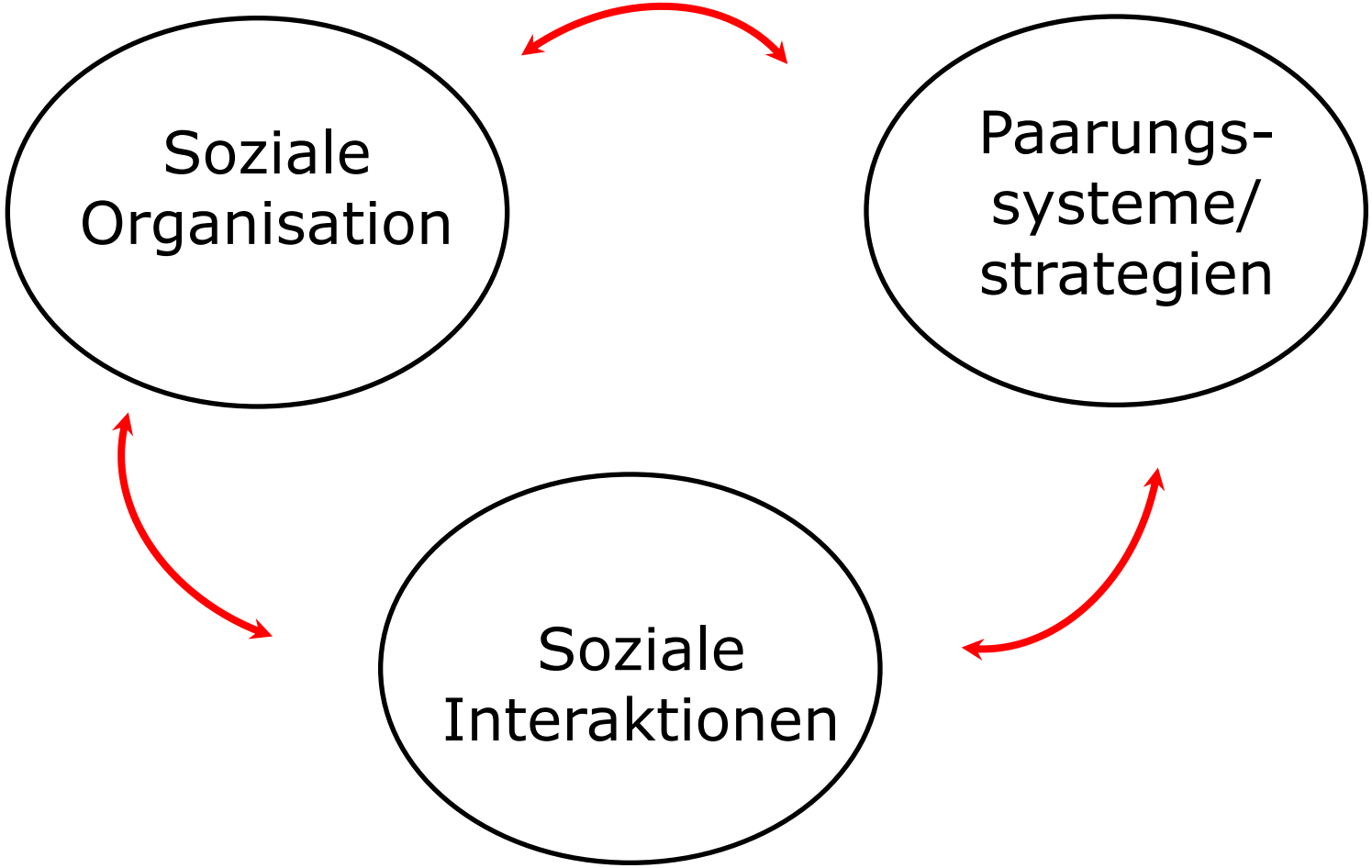
Allein oder in Gruppen?
Verwandtschaftsverhältnisse?
Räumliche Verteilung?

Wer paart sich mit wem?



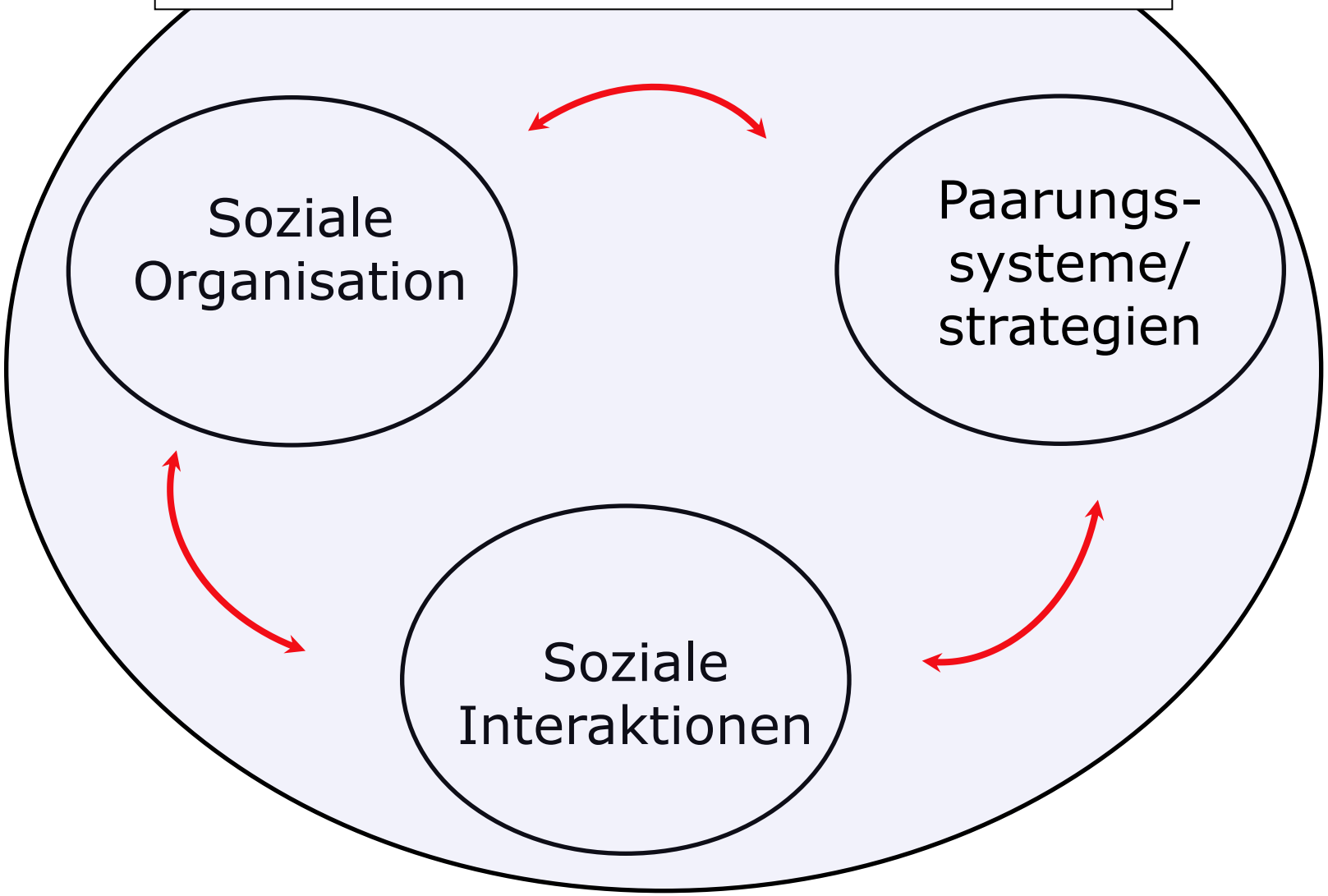
Allein oder in Gruppen?
Verwandtschaftsverhältnisse?
Räumliche Verteilung?

Wer paart sich mit wem?



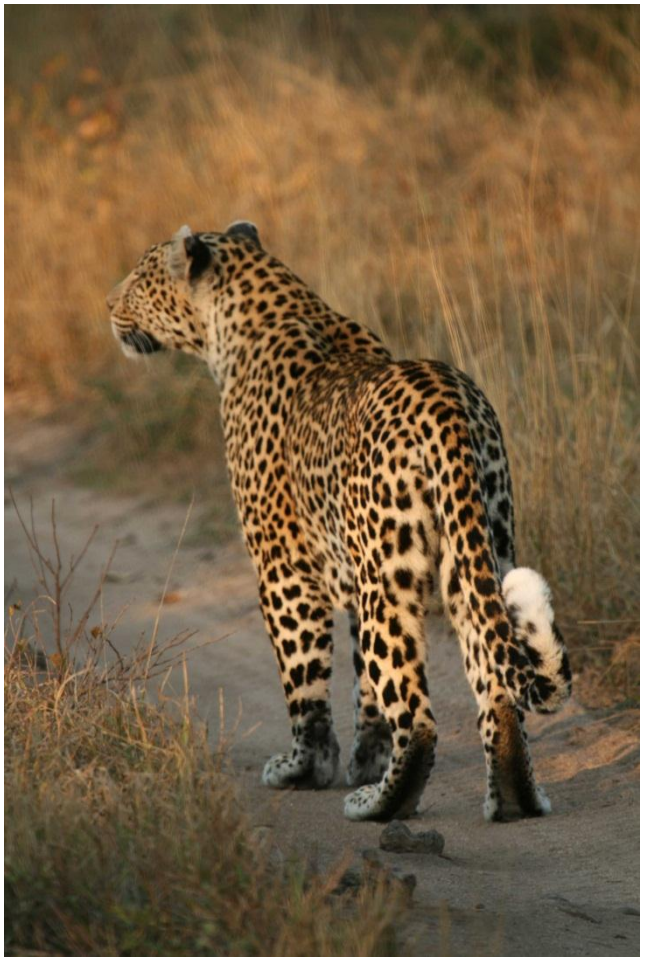
Konkurrenz//Aggression//Kooperation unter Individuen

Sozialsystem



z.B.: Kappeler, Verhaltensbiologie

a) Soziale Organisationsformen



solitär

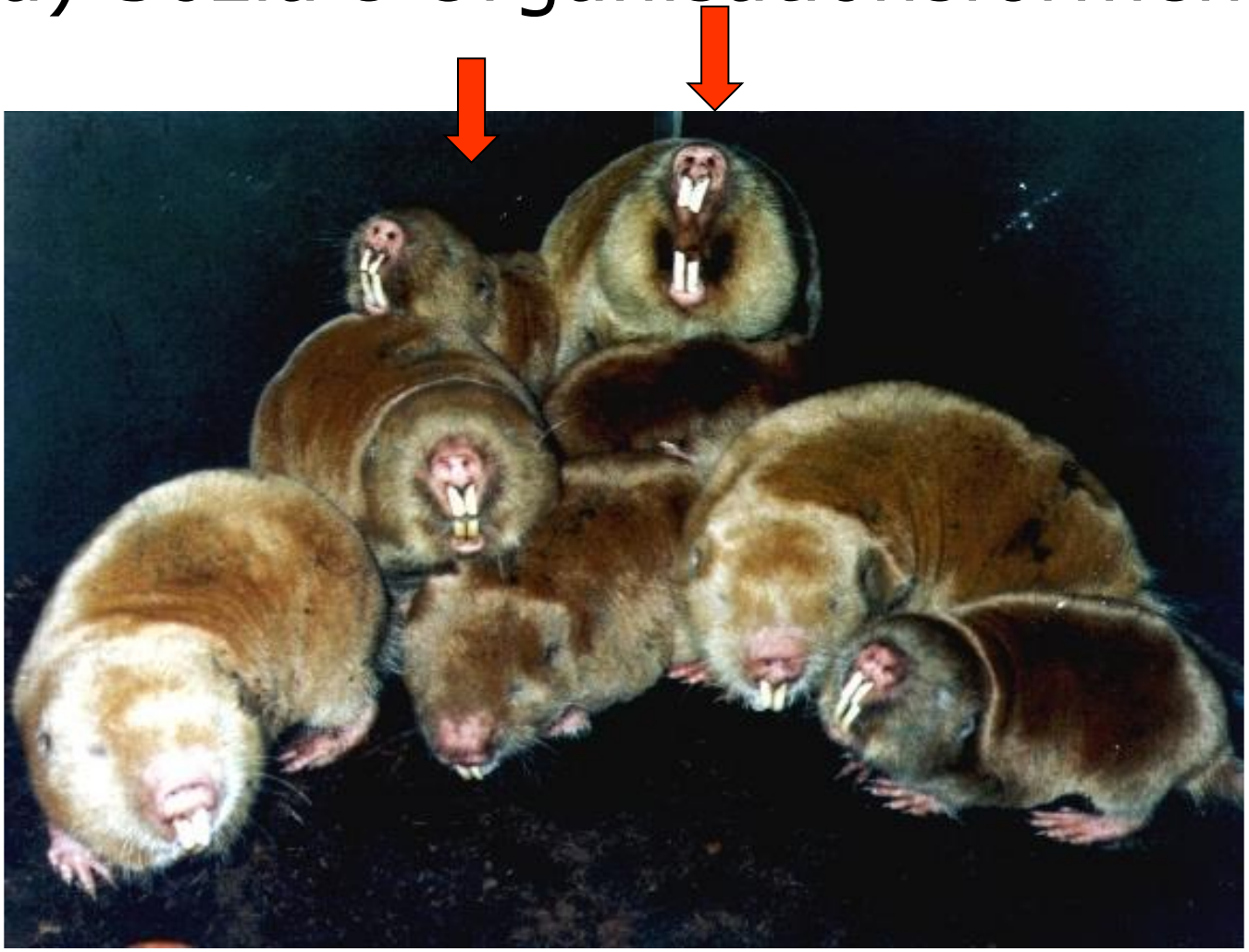
z.B. viele Großkatzen

a) Soziale Organisationsformen

stabile Paare

z.B. Schabrackenschakal

a) Soziale Organisationsformen



erweiterte Familienverbände

z.B. Graumulle

a) Soziale Organisationsformen

Kooperative Gesellschaften

(+/- stabil, Individuen kennen sich)

z.B. Erdmännchen, Präriehunde, Schimpansen)

a) Soziale Organisationsformen

anonymisierte Zweckgemeinschaften

z.B. Gnus, Zebras

a) Soziale Organisationsformen:
Geschlechtsunterschiede

Männchen-Gruppen

Weibchen-Gruppen

a) Soziale Organisationsformen:
Innerartliche Variabilität

Mehrere Weibchen + Nachwuchs

a) Soziale Organisationsformen:
Innerartliche Variabilität

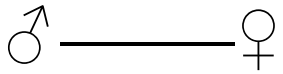
Keiler: solitär

a) Soziale Organisationsformen:
Innerartliche Variabilität

Keiler im 2. Jahr

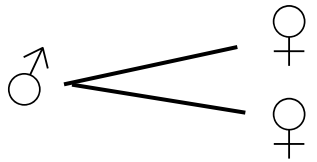
b) Paarungssysteme: wer mit wem?

<u>Monogamie:</u>

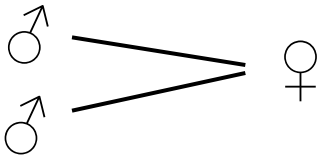


<u>Polygamie:</u>

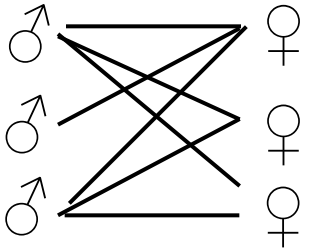
Polygynie:



Polyandrie:



Promiskuität:



b) Paarungssysteme: wer mit wem?

Monogamie

(z.B. Schabrackenschakal, Graumull)

b) Paarungssysteme: wer mit wem?

Polygynie
(z.B. viele Hirsche)

b) Paarungssysteme: wer mit wem?

Polyandrie

(z.B. viele Tamarin-Arten)

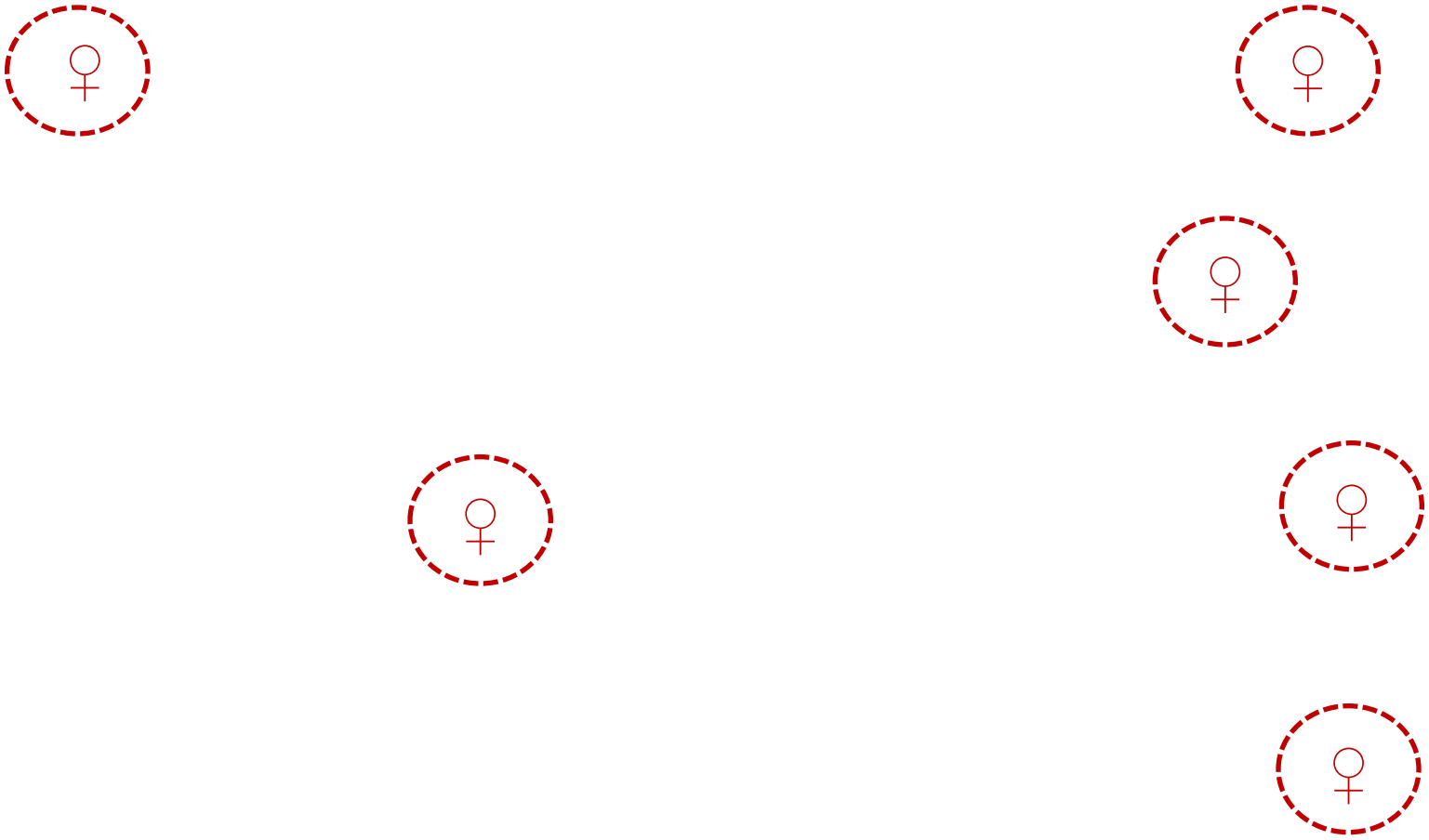
b) Paarungssysteme: wer mit wem?

Promiskuität

(z.B. Schneeschuhhase)

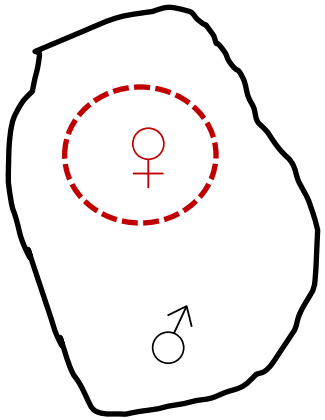
c) Soziale Interaktionen:

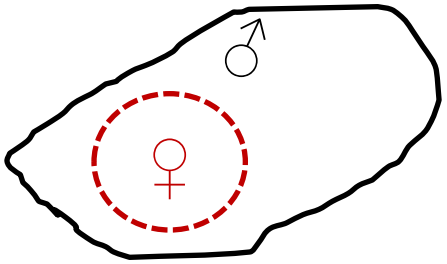
Verteilungsmuster und Territorialität

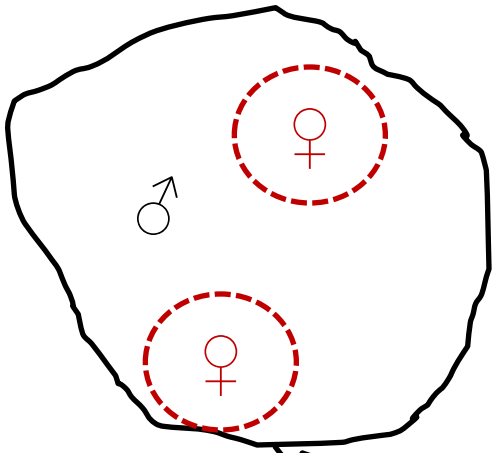


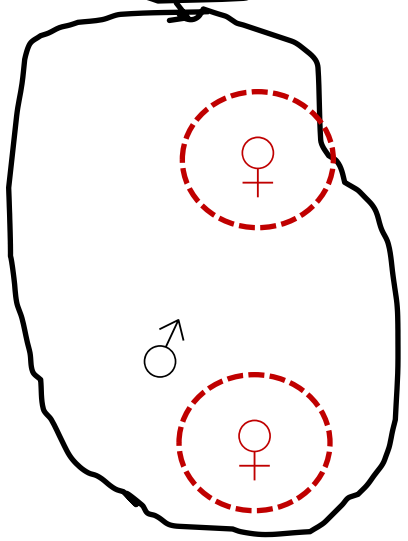
c) Soziale Interaktionen:

Verteilungsmuster und Territorialität









„The resident always wins!“

c) Soziale Interaktionen:

Verteilungsmuster und Territorialität

Despotismus, Hackordnung

Sozialsysteme bei Nagetieren

Feldhamster

Solitär, territorial

Siebenschläfer

Sozialsysteme bei Nagetieren

Monogame Paare, temporär mit Nachwuchs

Eurasischer Biber
(*Castor fiber*)

Kanadischer Biber
(*C. canadensis*)

Sozialsysteme bei Nagetieren

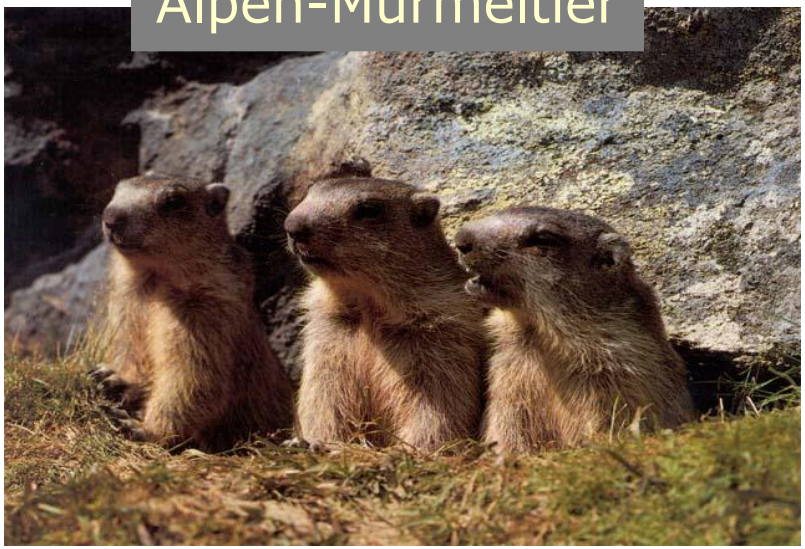
Monogame Paare, ständig mit Nachwuchs

Nacktmull

Sozialsysteme bei Nagetieren

Kolonial, polygyn - promisk

Alpen-Murmeltier



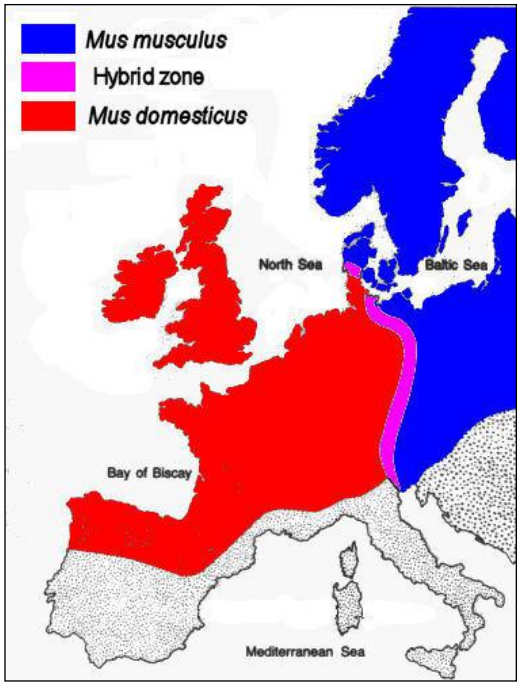
Präriehund

Ziesel

Zusammenfassung Sozialsysteme:

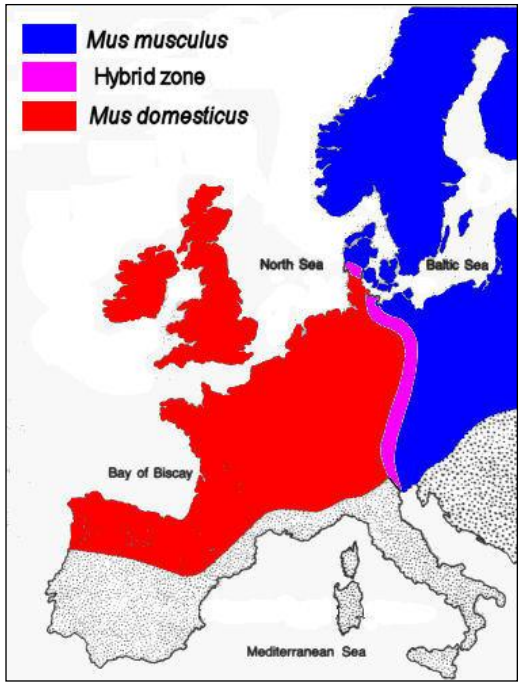
- Zusammenspiel aus sozialer Organisation, Paarungssystem und sozialen Interaktionen
- Oft hohe innerartliche Variabilität
- Modulation durch aktuelle Umweltbedingungen
- Geschlechter oft mit unterschiedlichen Strategien und Verhaltensweisen
- Nagetiere weisen (annähernd) volles Spektrum auf

Hausmaus (*Mus musculus*)



- Ursprung: Indien
- Mind. 2x als Kulturfolger eingewandert (erstmals vor ca. 10000 J.)

Hausmaus (*Mus musculus*)



- Habitat: meist eng an menschlichen Behausungen
- dort sehr anpassungsfähig und flexibel:
  Getreidekammern, Scheunen, Keller, Dachböden, …

Hausmaus (*Mus musculus*)

- Versteckt gebautes Nest (Schlafnest, Jungenaufzucht)
- gemeinsame Jungenaufzucht („Allo-Lactation“) häufig

Hausmaus (*Mus musculus*)

<u>B. König, Zürich (seit 90er Jahre):</u>

wilde Hausmäuse in semi-natürlichem, überdachten Gehege; ungestörte Fortpflanzung, Zu/Abwanderung

- gemeinsame Jungenaufzucht verwandter Mütter optimiert Fortpflanzungserfolg (König 1994, 1997)

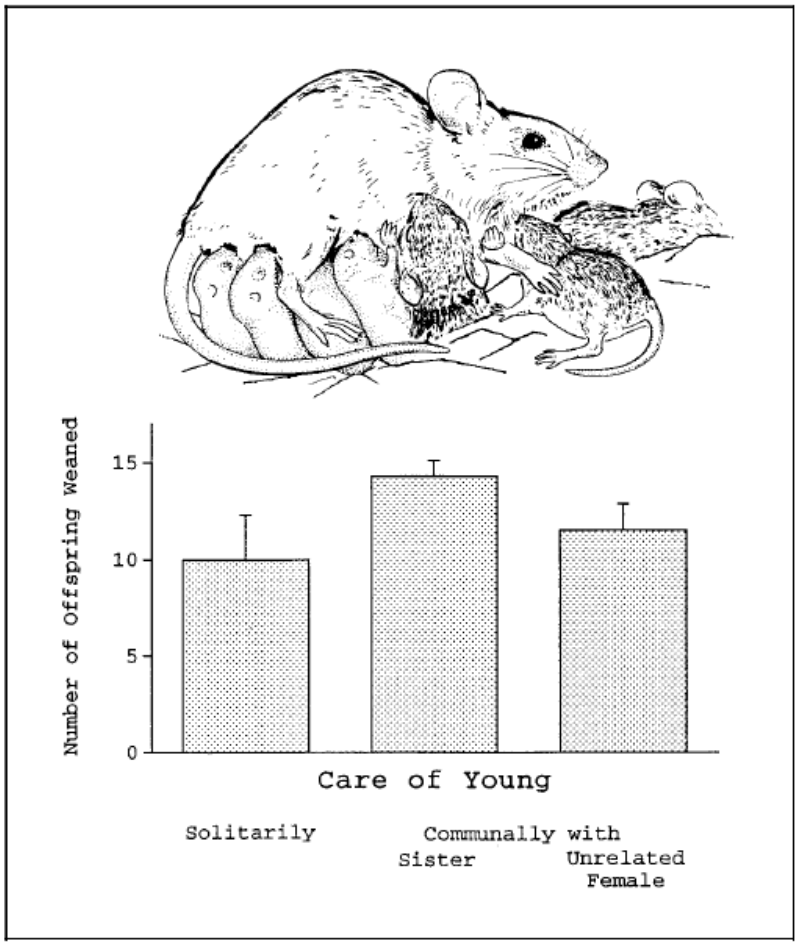


Fig. 4. Female house mice (*Mus domesticus*) that rear litters communally with a sister wean more offspring during their lifetime (under laboratory conditions) than females rearing litters alone or in the presence of a previously unfamiliar, genetically unrelated partner. Data are given as medians plus standard errors. (Data from [83])

aus: König 1997

Hausmaus (*Mus musculus*)

SOCIAL DOMINANCE AND DARWINIAN FITNESS IN THE LABORATORY MOUSE

Levin, Petras, and Rasmussen (1969) have recently discussed the maintenance of the *t*-allele polymorphism in natural populations of house mice (*Mus musculus*). Although *t* alleles are recessive lethal or male sterile, most natural populations are polymorphic for alleles at the *T* locus. An abnormal segregation or transmission ratio of about 0.95 in heterozygous males is apparently responsible for the maintenance of this polymorphism. However, the observed *t*-allele frequency in natural populations is approximately half that expected on the basis of deterministic models which assume infinite population size and random mating. Lewontin and Dunn (1960) have suggested that this discrepancy may be due to the effects of random genetic drift. They postulated that mice live in small family units (demes), a large fraction of which would become fixed for the normal allele; thus, when a geographical population composed of demes is sampled, the observed frequency of the *t* allele will be less than that calculated from deterministic models.

Levin, Petras, and Rasmussen (1969) employed a Monte Carlo simulation of a geographical population of house mice to examine the range of breeding-unit sizes and interdemic migration rates which were compatible with the random-drift hypothesis. Assuming a transmission ratio of 0.95 for lethal *t* alleles, it was found that random drift would have an important effect on *t*-allele frequencies in populations with migration between demes approaching 0% only when the effective breeding-unit size was less than 12. For populations with interdemic migration rates of 1% or 3%, the effective population size would have to be less than eight or four,

DeFries & McClearn 1970

Set-Up:

3 ♀♀ + 3 ♂♂ in 3 verbundenen Käfigen

♂♂:

heftige Rangkämpfe; 1 ♂ dominiert beide anderen; bewegt sich frei, monopolisiert Reproduktion

subordinate ♂♂ +/- inaktiv in peripherem Käfig; kaum Reproduktion; hohe Mortalität

Hausmaus (*Mus musculus*)

SOCIAL DOMINANCE AND DARWINIAN FITNESS IN THE LABORATORY MOUSE

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DeFries & McClearn 1970

Set-Up:

3 ♀♀ + 3 ♂♂ in
3 verbundenen Käfigen

♀♀:

- bewegen sich frei
- alle 3 ♀♀ reproduzieren
- Aggressionslevel niedrig

Hausmaus (*Mus musculus*)

Hurst (1987):

4 Gründer-Paare wilder Hausmäuse in Freigehege; 2 Jahre ungestörte Fortpflanzung

Grundmuster:

- Männchen markieren und verteidigen Territorium
- aggressives Verhalten gegenüber anderen Männchen!

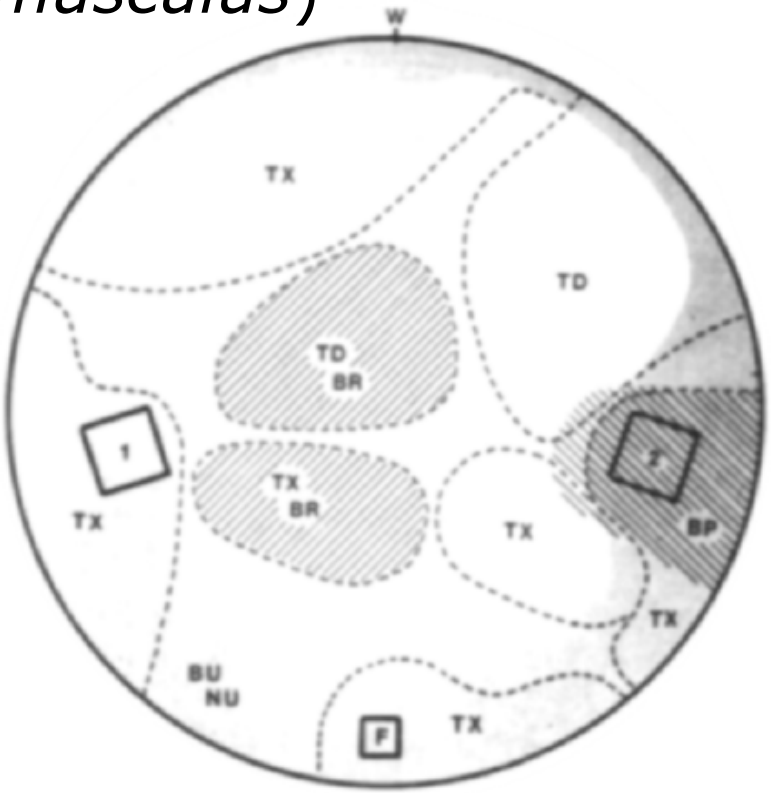


Figure 1. Spatial distributions of adult mice over the 6-week study period, and location of nest boxes (1, 2), food pot (F) and water spout (W). Dashed lines indicate approximate borders of the eight male territories, though there were minor variations during the study. Non-territorial males and Non-breeding Restricted females lived within and between the dominance territories (TD). Unrestricted females (classes BU, NU) spent most of their time in the shaded area, while hatched areas indicate ranges of Breeding Restricted females (BR) and females with partial access to high quality resources (BP). Social classes are described in Table I.

aus: Hurst, 1987

Table I. Social classes of mice observed in the enclosure

Name	Acronym	Description
Males		
Exclusive territorial	TX	Defended territories with the exclusion of all other males and some females. Mated with females. Previously described by Crowcroft 1955, 1966; Crowcroft & Rowe 1963; Poole & Morgan 1976
Dominance territorial	TD	Defended an area against other males, particularly excluding other territorial males. Some subdominant and subordinate males tolerated, though encounters frequently led to the attack and pursuit of SD, and attack of SO males. Mated with females. Previously described by Reimer & Petras 1967; Mackintosh 1970; Poole & Morgan 1976
Subdominant	SD	Lived within dominance territories, sometimes contributing to defence, and often invaded other territories. Attacked by females in invaded and home territories, but were generally in good condition with few bite scars. Sometimes rested in huddles with other mice but were frequently found alone. Never seen mating, though attempted to mount females. Previously described by Crowcroft 1966; Evans & Mackintosh 1976; Poole & Morgan 1976
Subordinate	SO	Lived within dominance territories but movements were more limited than SD and they were usually found in a huddle with other mice. They were of medium to poor physical condition, judging from bite scars and fur loss. Largely non-aggressive, but there was some mutual fighting. Never seen mating. Previously described by all authors given above
Young adult subordinate	SY	Spent most of their active time in resource areas, despite being attacked and chased by resident males and females (sometimes tolerated by females). In excellent physical condition but never seen mating. Behaviour similar to older offspring described by Crowcroft 1966

Hausmaus (*Mus musculus*)

Zusammenfassung:

- Territorial-polygnes System bei niedrigen Bestandsdichten

- Mit wachsender Populationsdichte wächst auch Komplexität der sozialen Interaktionsmuster

- Aggressionslevel generell höher unter ♂♂

- Agonistische Auseinandersetzungen setzen unterlegene ♂♂ z.T. hohem Stress aus, wenn Rückzugsmöglichkeiten fehlen

Rattus sp.

- Fam. Muridae; 65 Spezies; 40 – 500g
- Verbreitungsschwerpunkt: SO-Asien, Australien
- Weltweit v.a. durch Schiffsverkehr
- Krankheitsüberträger (u.a. Pest, Hanta-Virus, Leptospiren, …)

Hausratte (*R. rattus*)

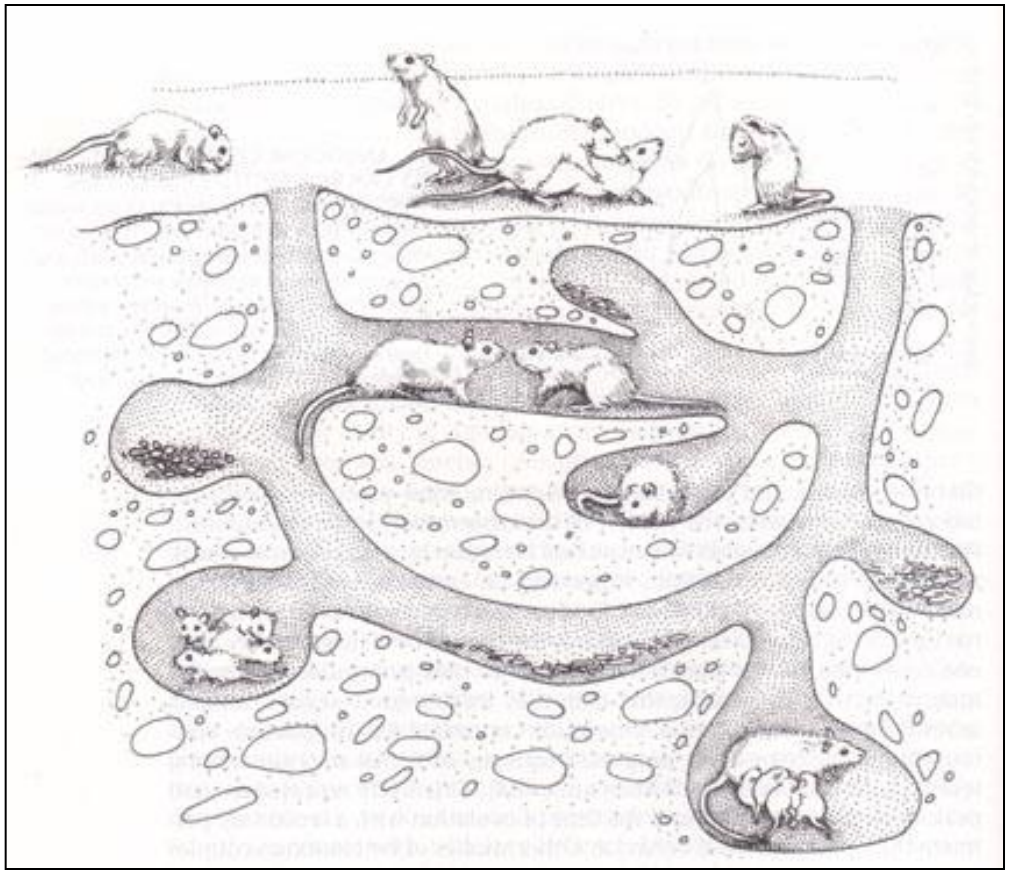
u.a. in Europa seit Mittelalter

Wanderratte (*R. norvegicus*)

seit 16. Jh in Europa,
seit 18. Jh in Amerika

Wanderratte (*Rattus norvegicus*)

- heute: weltweite Verbreitung!
- meist (aber nicht immer!) in der Nähe des Menschen
- erfolgreiche Ansiedlung auch in stark urbanen Habitaten
  → extrem hohes Maß an Flexibilität und Anpassungsfähigkeit



- i.d.R. 1 - mehrere ♀♀, 1 ♂, Nachwuchs
- ♀♀ z.T. mit gemeinsamer Jungenaufzucht und gemischten Würfen, aber auch z.T. mit Infantizid
- Infantizid seltener, wenn Mütter verwandt
- Dominanzstrukturen unter ♀♀; dominante ♀♀ mit höherem Reproduktionserfolg

Calhoun (1963):
wilde Ratten in 1000qm großem Freigehege

Phase I:
- ♀♀ legen Nestbauten an präferierten Stellen an
- ♂♂ besetzen Territorien um ♀♀ herum; mate guarding
- territoriale Stabilität
- gute Reproduktion bei allen Tieren

Phase II:
- Nachwuchs besetzt ungünstigere Teile des Geheges
- junge ♂♂ nicht territorial, formen z.T. große „Packs"
- territoriale ♂♂ nicht mehr in der Lage, ♀♀ zu monopolisieren
  → "Gruppenvergewaltigungen", Despotismus
- Gesamt-Reproduktionsrate vermindert

Konsequenzen für die Haltung

- beide Spezies territorial/polygyn – despotisch-promisk (abhängig von Bestandsdichte)
- Käfighaltung macht Ausbildung von Territorien unmöglich → Dominanzstrukturen v.a. unter ♂♂
- Ratten-♂♂ neigen offenbar stärker als Maus-♂♂ zu Koalitionsbildung → Gruppenhaltung möglich
- Natürliche Situation: gemischt-geschlechtlich mit distinkten Rückzugsmöglichkeiten…

Danke für Ihre Aufmerksamkeit…und
viel Spaß bei den nächsten Vorträgen!